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ABSTRACT

This study was designed to investigate a specific skill pattern as it relates to kinesthetics and hand dominance. The specific skill pattern investigated was the ability of subjects, using either their dominant or nondominant hand, to catch a ball when they were unable to see their arm or hand. An "L" shaped curtain containing a hole for the ball to pass through was used for this study. The side of the curtain contained an arm sleeve which allowed the subject to see the ball in its parabolic flight pattern but did not allow the subject to see either her arm or hand. One hundred sixty high school girls were randomly chosen and assigned to one of the following four experimental treatment variables: (1) dominant hand kinesthetic catching ability, (2) dominant hand visual catching ability, (3) nondominant hand kinesthetic catching ability, and (4) nondominant hand visual catching ability. It was found that there was a significant difference between vision and kinethesis in the ball catching task. A significant difference was also found between dominant and nondominant hands in the catching task. No significant difference was revealed between dominant and nondominant hand catching ability in the visual catching task. (Author)

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# KINESTHETIC ABILITY AS RELATED TO A BALL CATCHING TASK WITH DOMINANT AND NON-DOMINANT HANDS

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This study was designed in an attempt to investigate a specific skill pattern, namely that of ball catching, as it related to kinesthetics and hand dominance.

The possession of kinesthetic ability in the performance of a skill has been shown to be highly specific to the skill being performed. Though kinesthetic ability has been shown to be specific to the skill, little research has been conducted which attempts to evaluate kinesthetic ability as it relates to a specific skill pattern.

Whiting (1969) has, however, done an extensive amount of research on ball catching. He is on the opinion that there is nothing innate in a person's ability to understand the parabolic flight pattern of a ball. This is something that is acquired only through practice and experience. Whiting states that the beginner will characteristically attempt to hold the arms so they can be sighted in relation to the ball in flight. But, as the player becomes more experienced, the catching task is brought about purely on the basis on proprioception.

A one-handed ball catching task requires both spatial and temporal orientation and anticipation of the arm and hand. Spatial anticipation involves learning to predict where a stimulus event will occur and temporal anticipation involves learning to predict when a stimulus event will occur. Dorfman and Goldstein (1975) state that these are both

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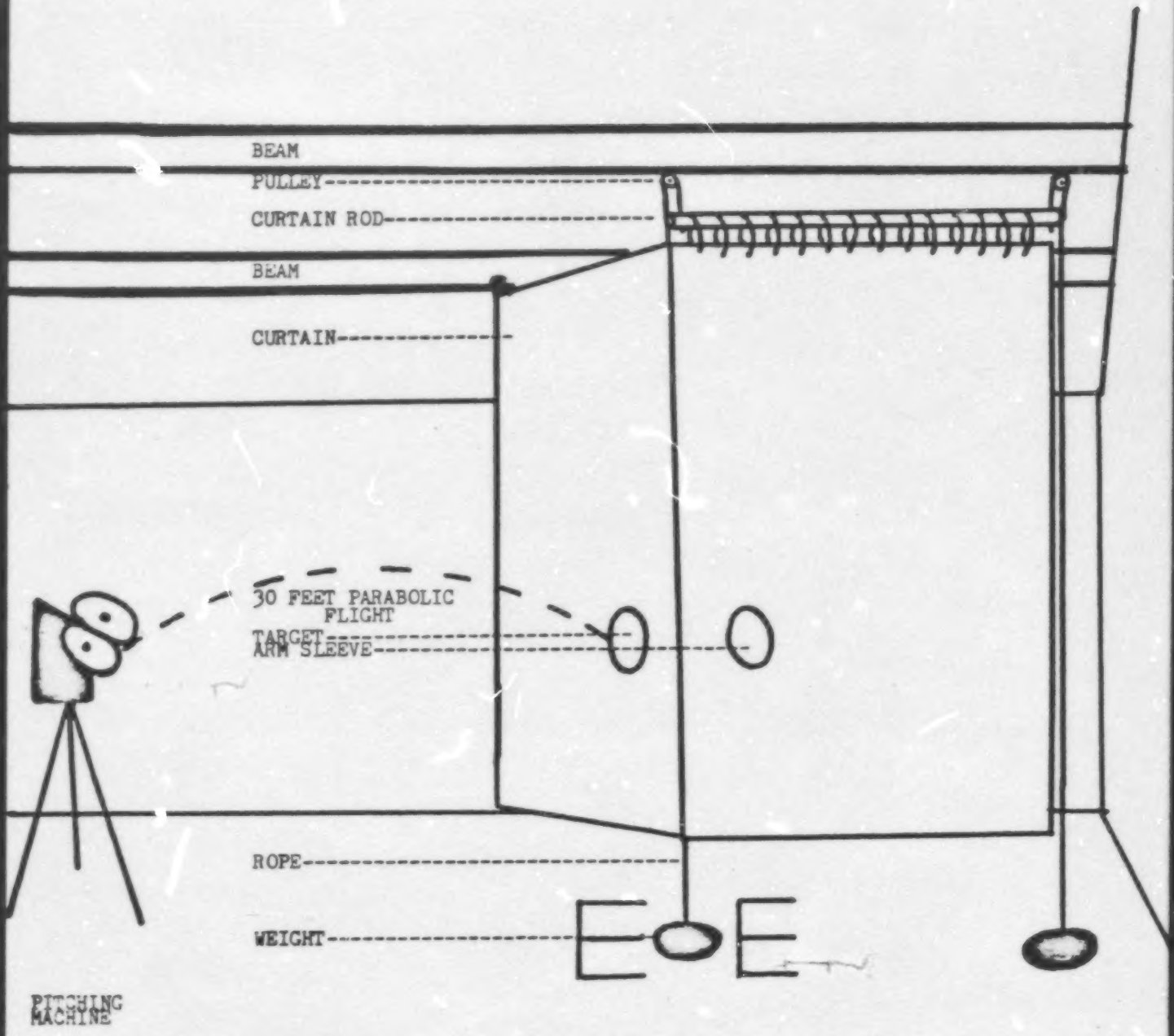
Experimental Layout

Right Hand Catching View

Figure 1



learned processes and that in order to catch a ball it is essential to visualize or predict the spatial-temporal characteristics of the ball's trajectory.

Hand dominance as related to ball catching should also be given some consideration. Cratty (1973), Glencross (1970), Tyler (1971), and Phillips and Summers (1954) state that the preferred arm performs better than the non-preferred arm based on the experimental research they have conducted. However, Glencross (1970) and Tyler (1971) think that this is a result of practice and experience. Thus, if a person learned to catch a ball with their non-dominant hand, as is the case with using a glove in softball or baseball, then it would seem logical to assume that they might be able to catch as well with their non-dominant hand although no evidence is found to support this assumption.

In discussing vision and kinesthesis, Thorsheim (1974), Posner (1973), and Rock and Harris (1967) agree that when both are presented together, vision will override kinesthesis. However, Laszlo and Baker (1972) are of the opinion that once a subject has learned to rely on visual and kinesthetic cues, he cannot perform as accurately when the kinesthetic cues are removed.

## Method

### Apparatus

In order to evaluate kinesthesis and hand dominance as they are related to a ball catching task, an "L" shaped curtain was designed so the subject could see the ball but could not see her arm or hand when she attempted to catch the ball. (refer to Figure 1) The subject stood

Illustration of a 2 x 2 Factorial Design

**Figure 2**

| | Kinesthetic Ability | Visual Ability |
|---|---|---|
| Non-dominant Hand Catching | Non-dominant Hand Kinesthetic Ball Catching Ability | Non-dominant Hand Visual Ball Catching Ability |
| Dominant Hand Catching | Dominant Hand Kinesthetic Ball Catching Ability | Dominant Hand Visual Ball Catching Ability |

in the marked area and placed her arm in the arm sleeve. The ball was thrown from the pitching machine through the target hole and the subject attempted to catch the ball even though she could not see her arm or hand.

Subjects

The 160 subjects were randomly chosen from the girls enrolled in Physical Education at MacArthur High School in Aldine Independent School District, Houston, Texas.

Procedure

The subjects were randomly assigned and tested on one of four experimental treatment variables: catching kinesthetically with the dominant hand, catching visually with the dominant hand, catching kinesthetically with the non-dominant hand, and catching visually with the non-dominant hand (refer to Figure 2). Visual catches were performed without the arm sleeve but the circular target hole was used. Data was collected on the number of times out of ten the subject could hit or touch the tennis ball.

Results

A two way analysis of variance was calculated to see if the data obtained from the four experimental treatment variables was significant (refer to Tables 1 & 2). Significance was found in the analysis of variance on catches but was not found in the analysis of variance on hits.

Table 1

Summary of Analysis of Variance on Catches

| Source of Variation | SS | df | MS | F |
|---|---|---|---|---|
| A Hand Usage | 36.100 | 1 | 36.100 | *6.675 |
| B Type of Catching | 193.600 | 1 | 193.600 | **35.799 |
| AB Interaction | .625 | 1 | .625 | .116 |
| Within Cell | 843.650 | 156 | 5.408 | |
| Total | 1073.975 | 159 | | |

*p≤.05
**p≤.01

Table 2

Summary of Analysis of Variance on Hits

| Source of Variation | SS | df | MS | F |
|---|---|---|---|---|
| A Hand Usage | 4.557 | 1 | 4.577 | .740 |
| B Type of Catching | 21.757 | 1 | 21.757 | 3.518 |
| AB Interaction | 9.505 | 1 | 9.505 | 1.537 |
| Within Cell | 964.675 | 156 | 6.184 | |
| Total | 1000.494 | 159 | | |

Since significance occurred in the analysis on catches, t tests were calculated to see where the significance occurred (refer to Table 3).

Table 3

Summary of Means and t Tests

| | Types of Catches | | | | | | |
|---|---|---|---|---|---|---|---|
| | Kinesthetic | | | Visual | | | |
| Hand Usage | X | SD | % | X | SD | % | t |
| Non-Dominant Hand | .975 | 1.54 | 9.75 | 3.30 | 2.55 | 33.00 | *4.780 |
| Dominant Hand | 2.05 | 1.99 | 20.50 | 4.125 | 2.81 | 41.25 | *3.77 |
| t | *2.67 | | | 1.34 | | | |

*$p \geq .05$

Significance was found in three of the experimental variables but was not found between dominant hand visual catching ability and non-dominant hand visual catching ability.

When discussing the results obtained, consideration must be given to the two aspects involved in the ball catching task. The first being the placement of the arm and hand in preparing to catch the ball and the second being the grasping of the ball by the hands and fingers.

As was mentioned earlier, there was no significant difference in the subject's ability to hit the oncoming tennis ball in the four experimental treatment groups. This suggested that kinesthesis was effective in placing the hand on an intercept course with the ball. Also, according to the statistics presented on the subject's ability to catch the ball, it appeared that vision was necessary for success in the ball catching task. However, when viewing these two findings

together, it appears that vision is only necessary in the grasping of the ball by the hands and fingers.

In referring to the percentage of catches it appears that the ball catching task was a difficult one in that the subjects could not catch fifty percent of the balls thrown to them (refer to Table 3). Thus, subjects quite possibly did not have much experience in catching tennis balls.

Table 4

Summary of Means

| | Types of Hits | | | | | |
|---|---|---|---|---|---|---|
| | Kinesthetic | | | Visual | | |
| Hand Usage | X | SD | % | X | SD | % |
| Non-Dominant Hand | 6.35 | 2.62 | 63.50 | 6.10 | 1.51 | 61.00 |
| Dominant Hand | 6.50 | 2.26 | 65.00 | 5.28 | 2.48 | 52.75 |

However, when referring to the percentages presented in Table 4, it appears that subjects were able to intercept and deflect the ball during it's parabolic flight pattern in over fifty percent of the balls thrown.

These results suggest that the subjects had previous experience in ball flight patterns. But, they also suggest that the subjects were unfamiliar with timing the grasping action of the hand and fingers since they could make contact with the ball but could not hold on to it.

In reviewing the results on hand dominance, it appears that the subjects can visually catch equally well with their non-dominant hand as

they can with their dominant hand. However, in view of the fact that the subjects could not kinesthetically catch equally well with their non-dominant hand infers that vision is necessary for better performance of the non-dominant hand in the ball catching task. Subjects will apparantly perform better with their dominant hand when they are placed in a situation where they cannot see their hand in catching a ball. Quite possibly these subjects learned enough to function in a normal situation requiring them to catch with their non-dominant hand. But, when it came to performing under more difficult conditions, namely the kinesthetic ball catching task, the dominant hand was superior in it's ability to catch the ball.

Conclusions

When viewing the findings presented from this study the conclusions should be limited to subjects of similar skill ability to those who participated in this research. Based on this limitation, the general conclusions that can be drawn from this study are as follows:

1. Subjects do not differ in the spatial orientation of the hand and arm in the visual and kinesthetic ball catching tasks.
2. Subjects performed better in grasping and holding the ball when they were able to view the hand throughout the ball flight pattern.
3. Subjects can visually catch a ball equally well with their non-dominant or dominant hand.
4. Subjects will perform better with their dominant hand as compared to their non-dominant hand when they are unable to view their hand in the ball catching task.

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